The specificity of emotion inferences as a function of emotional contextual support

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Abstract

Research on emotion inferences has shown that readers include a representation of the main character's emotional state in their mental representations of the text. We examined the specificity of emotion representations as a function of the emotion content of short narratives, in terms of the quantity and quality of emotion components included in the narratives, based on the GRID instrument (Fontaine et al., 2013). In a self-paced reading task, target sentences that only moderately matched the emotional context were read faster than target sentences that strongly matched the emotional context of the narratives. In a "makes sense" judgment task, we showed that this result was not driven by a mapping difficulty and, in a memory task, we provided some evidence that these effects reflected integration processes. We suggest that readers can integrate specific emotions into their mental representations, but only if provided with the appropriate emotional contextual support.

Keywords: emotion inferences, match vs. mismatch paradigm, optimal congruent vs. moderate congruent paradigm, mapping processes, integration processes

The specificity of emotion inferences as a function of emotional contextual support

Comprehending a text requires readers to go beyond the words and to form mental representations partly based on the information transmitted by them. These mental representations, also called *mental models* (Johnson-Laird, 1983) or *situation models* (Kintsch, 1988), do not only contain elements made explicit in the text but also implicit elements. As the text unfolds, readers include these implicit elements in their mental representations by making inferences based on their general knowledge.

Part of the research on inferences has tried to focus on the specific nature of emotions in readers' mental representations. In other words, some researchers (e.g., Gygax, Oakhill, & Garnham, 2003; Gygax, Garnham, & Oakhill, 2004) have questioned whether readers include specific emotion labels in their mental representations of the text, and therefore differentiate between similar emotions such as *sad* and *depressed*, or infer only global emotional states. Although we will come back to this notion of specificity, it is important to stress that in these studies, as in other studies on inferences in text comprehension, the *match vs. mismatch* paradigm has mostly been used. In this paradigm, participants are presented with short narratives intended to elicit mental representations of the main protagonist's emotional state. At some point, each narrative usually includes a target sentence that either matches or mismatches the intended emotion. The time taken to read this target sentence is typically recorded and the processing time of the matching sentence is compared to the time needed to process the mismatching one. This paradigm assumes that the time to read target sentences mirror how similar the information in these sentences is to readers' mental representations: People are faster at reading matching sentences than mismatching ones (i.e., those that contradict their current mental representations). With mismatching sentences, a relatively effortful process of adjustment has to be activated, which is reflected in longer reading times. Importantly, faster reading times for congruent than for incongruent sentences, as previously

noted by Gernsbacher et al. (1992) or Gygax, Tapiero, and Carruzzo (2007), might not indicate that inference processes occurred *during* reading, as they might simply mirror how easily the content of the target sentences can be mapped onto readers' current mental representations (i.e., backward inferences). Therefore, at times, reading times may be more indicative of the off-line processes (i.e., processes occurring *after* reading) at stake when reading target sentences. Although it is difficult to use reading times from the *match vs. mismatch* paradigm to differentiate between forward and backward inference processes, reading times always indicate that information *is* more or less easily mapped onto readers' current mental representations. We therefore argue that reading times are still indicative of inference processes.

As such, using the *match vs. mismatch* paradigm, Gernsbacher et al. (1992) showed that readers, when presented with a narrative that induces a representation of the main character's emotion, were faster to read a target sentence that contained a matching emotion (e.g., guilty) than mismatching converse emotion (e.g., proud) or a mismatching emotion label of the same valence as the intended emotion (e.g., shy). The authors concluded that readers do infer precise (or *specific* in terms of Gygax et al., 2003) emotions when reading, and not only some information merely associated with valence.

However, Gygax et al. (2003) showed that even if emotion inferences contain more than just valence, it did not necessarily mean that they were precise. These authors used the same narratives and target emotions as in Gernsbacher et al. (1992), but also tested target sentences including an emotion *synonymous* with the one tested by Gernsbacher et al. (e.g., ashamed) and target sentences including a *similar,* but not synonymous emotion (e.g., upset). Although readers always slowed down when encountering the mismatching target sentence, they were equally fast to read the different matching sentences (i.e., initial, synonymous, and similar emotions). In a following study, Gygax et al. (2004) tried to create conditions that

would result in readers making specific emotion inferences. In a first experiment, they included more emotion information in their experimental narratives (i.e., they doubled the length of the text). In a second experiment, the narratives were made ambiguous, but comprehensible by inferring the protagonist's emotion, thus encouraging the participants to establish text coherence by drawing on specific emotion inferences. Nonetheless, even when incited to include specific emotion terms in their mental representations of the text (in both modified versions), participants did not show more specific emotion inferences than those of Gygax et al. (2003). The different matching emotions were always read similarly.

One possible way to explain the non-specificity of emotion inferences was proposed by Gygax et al. (2007), who suggested that emotion inferences might be elaborated in a constructivist and incremental manner. According to the authors, emotional inference may be based on a sum of stereotypical components, such as valence or the behavioral responses associated with emotions. Instead of inferring an emotion *per se*, readers may infer some core components of this emotion that can be shared by similar emotions. In other words, the lack of difference between the different matching conditions shown in previous studies may result from the fact that readers included some stereotypical information (e.g., the valence of the emotion or a behavior associated with it) in their mental representations of the text but did not need to infer a specific emotion word.

Inferring stereotypical information related to emotion would allow readers to rely on salient characteristics of the emotion while keeping the representation broad enough to adapt it to new information easily (i.e., a behavior is often shared by more than one emotion). This early-stage representation might be completed as new information (i.e., related to other components) is made available to readers. If readers construct their mental representation of an emotion in the same way as an emotional response to an emotion-eliciting situation, they would require all relevant, and consequently necessary, emotion components – explicitly in

the text or inferred – to activate a *precise* emotion. By activating and integrating only one or two components in their mental representations, readers are unlikely to elaborate a precise emotion representation. The lack of specificity of emotional inferences found in previous studies might therefore simply emanate from the insufficient emotional content of the narratives (i.e., contextual support) used to test emotion inferences. In other words, the narratives used could never allow readers to reach more elaborate, and hence precise, emotions.

This idea mimics research on the influence of contextual support on different types of inferences, such as predictive inferences. These inferences, which trigger information about future events or outcomes in the text, are not truly necessary for comprehension, and are consequently only activated in limited situations. In fact, readers only engage in the activation of predictive inferences if strong contextual support is provided in the text, combined with an inference-evoking sentence (e.g., Casteel, 2007; Cook, Limber, & O'Brien, 2001; McKoon & Ratcliff, 1986). As the contextual support increases, predictive inferences become more specific, and readers activate fewer lexical candidates that mirror the intended predictive inference (e.g., Lassonde & O'Brien, 2009). Although the specificity of predictive inferences may depend on contextual support, it may also depend on readers' constructed mental representations that may enable them to generate those inferences. For example, Rapp, Gerrig, & Prentice (2001) showed that the specificity of trait inferences (i.e., the main character is *generous* instead of simply *good*), in turn, dictated the specificity of predictive inferences (e.g., *donating money*).

In terms of lexical candidates, enhancing the specificity of an inference does not mean that only one lexical item (i.e., the intended inference) is activated in readers' mental representations, but rather that the amount of potential items, or candidates, is reduced. By applying this principle to emotion inferences, we can hypothesize that providing strong

emotional contextual support should activate fewer lexical candidates, hence more specific emotion representations.

In this paper, we present a way to construct experimental materials suited for investigating the influence of emotional contextual support on emotion inferences. By extension, we also aimed to examine a possible way to shift from the habitual match-mismatch effects to *only* encompassing matching conditions when investigating emotion inferences. Therefore, in the present paper, we attempted to (1) rely on emotion research to better ensure the quality of emotion information in our experimental narratives, (2) rely on differential levels of congruency only (*moderate*, *suitable,* and *optimal*), and consequently (3) explore more subtle processes than those revealed by previous studies relying on the *match vs. mismatch* paradigm. Rather than comparing target sentences that contain matching emotions to target sentences containing mismatching emotions, we compared the same emotion target sentences preceded either by a highly constraining context or by a less constraining yet still congruent context. This paradigm reduces the difference between the conditions and may reveal processes that were not apparent in previous studies based on the *match vs. mismatch* paradigm.

Emotion research serving psycholinguistics

We manipulated the contextual emotional information by relying on Scherer's (1984, 2005) definition of emotion as a result of synchronized and interrelated changes in five components linked to the different subsystems (e.g., *action* or *information processing*) of the organism. Among the components, the *appraisal* component corresponds to the evaluation of the situation that triggers the emotion. The *expression* component involves the changes in face, voice, and gesture. The *action tendency* component relates to the motivational aspect of emotion, and the *psychophysiological* component involves different bodily changes. Finally, the *subjective feeling* component is a monitoring component concerning the general feeling

associated with the event or situation. All components are highly interrelated, where changes in one produce changes in the others. Most importantly, the emotional responses are elicited in a dynamic and cumulative way (Ellsworth & Scherer, 2003; Scherer, 1984, 2009).

Crucially, according to the component process model (CPM, Scherer, 1984, 2009), all components are present in each emotional episode, and different emotions are elicited via different activations of these components (i.e., different component *features*). The GRID instrument (Fontaine, Scherer, Roesch, & Ellsworth 2007; Fontaine, Scherer & Soriano, 2013; Scherer, 2005) contains a set of 144 representative emotion features that reflect activity in the five components of emotion. The GRID instrument was developed to determine the features of the components that are likely to describe a given emotional episode. For example, for the emotion *anger*, a psychophysiological feature might be *a red face*. In previous validation studies (Fontaine et al., 2007, Fontaine et al., 2013), the authors identified the feature of each component that most appropriately characterizes a given emotion. This allows different features to be classified for each component of each emotion, from the most congruent to the most incongruent. For example, for *happiness*, the most congruent expression feature is *to smile* and the most incongruent feature is *to frown*. In between, features such as an *increase in the volume of a voice* or *having a trembling voice* are rather neutral, because they are neither judged as likely to happen nor as unlikely to happen. Crucially, although the GRID instrument showed that the meaning of emotion terms is relatively stable across more than 20 tested languages, the most congruent features do vary across languages. In the present paper, all selected features were bound to French.

We used the GRID scores to create controlled emotional narratives by manipulating the number of emotional components in the narratives and the congruency of their features. The reading experiments presented in this paper are consequently based on an *optimal congruent vs. moderate congruent* paradigm instead of a *matching vs. mismatching* paradigm.

This manipulation gives us the possibility of comparing specific emotional inferences in different conditions of congruency within each emotional narrative[1].

Based on previous results, we predicted that stronger contextual emotional support should activate more specific emotion representations. We therefore expected a congruent target sentence following a narrative with congruent but not constraining contextual support to be read slower than the same congruent target sentence following constraining contextual support

Importantly, our paradigm differs from the one used in previous studies in that only the content of the preceding sentences (i.e., in terms of emotional contextual support), but not the target sentence, changes across conditions. This allowed us to examine the same congruent target sentences across conditions and to distance ourselves from the habitual *match vs. mismatch* paradigm. In fact, our *moderate* condition (i.e., the *somehow less* congruent one) is still highly congruent in respect to the emotion content of the narratives. In other words, the congruency distance between our *optimal* and *moderate* conditions is much smaller than that between matching and mismatching conditions used in previous studies, which should enable us to address fine-grained inferential processes.

In light of the issues discussed above, it is important to construct appropriate narratives. We therefore present a pilot study to test adequate materials to address the issues presented so far.

Constructing narratives: Pilot Study

The goal of the pilot study was to construct emotional narratives based on the features identified in the GRID instrument and to show that these narratives did elicit the intended emotions.

Method

Participants.

Forty-eight students of an introductory psychology course from the University of Lausanne (Switzerland) took part in this experiment. All participants spoke French as their first language. There were 38 women and the participants were aged from 19 to 33 (M = 22.14, SD = 3.58).

Materials.

Emotional narratives. We constructed 24 narratives (see Table 1 for a full list of the emotions tested in our study), each corresponding to a French emotional label examined by Fontaine et al. (2007). Each narrative started with a sentence that introduced the main character and described the context of the story. This sentence was followed by five sentences, each related to one of the five emotion components (i.e., expression, appraisal, psychophysiology, action tendency, and subjective feeling). We wrote each narrative in three versions in order to manipulate the emotional contextual support in the narrative, as discussed earlier. We varied the degree of congruency of the components present in the narratives and the number of components across the narratives to get three levels of emotion context (i.e., *optimal*, *suitable* & *moderate*).

In the *optimal* version of each narrative, the most congruent feature of each component was included in its corresponding sentence. For example, in the narrative about *Happiness*, the most congruent feature of the expression component corresponded to *smile,* the most congruent feature of the psychophysiology component corresponded to *heartbeat getting faster*, and the most congruent feature of the appraisal component corresponded to *a situation in itself pleasant for the person*. In other words, the *optimal* version of each narrative contained the most congruent contextual support (as defined by the GRID instrument) to describe a specific emotion.

In the *moderate* version of each narrative, two components were removed in order to construct narratives containing less emotional contextual support in terms of quantity.

Because the majority of emotion theorists agree on a "reaction triad of emotion" (Scherer, 2000, p. 138) composed of physiological arousal, motor expression, and subjective feeling, and to make sure that our narratives would be less constraining according to all emotion theories, we eliminated the sentences related to expression and psychophysiology and replaced them with neutral filler sentences that did not convey any emotional information. In order to ensure that these filler sentences were neutral, we ran a pre-test in which eight students were asked to evaluate the extent to which 78 sentences intended to be neutral conveyed emotional information on a 6-point scale (0 = *does not convey any emotional information* to 5 = *conveys a lot of emotional information*). Out of these 78 sentences, we retained the 48 filler sentences that had the lowest scores ($M = 0.26$, $SD = 0.44$) and added them in the *moderate* versions of the narratives, ensuring that their meaning would not impinge upon the narratives' general meaning.

In the *suitable* version of each narrative, instead of altering the emotional contextual support in the narratives by removing emotion components, we altered the contextual support in terms of quality. We replaced the most congruent features of the expression and the psychophysiology components with less congruent features whereas the appraisal, action tendency, and subjective feeling components remained unchanged. In the narrative about *Happiness*, for example, the feature of the expression component *to smile* was replaced by *to speak faster*, whereas the feature of the psychophysiology component *heartbeat getting faster* was replaced by *breathing getting faster*. Note that when modifying the congruency of the features included in the *suitable* narratives, we carefully checked that these less congruent features did not make different emotions fit tightly to the revised narratives, as changing the value of some components in a narrative could make this narrative highly congruent with another emotion. In our materials, this was not the case.

In terms of contextual support, the optimal version of the narrative – containing all components described by highly associated features – was most specific to the intended emotion. The suitable version, as the optimal version, provided complete emotional contextual support in terms of components, yet was qualitatively attenuated for two components. The moderate version provided a congruent contextual support, yet the least congruent, as it was incomplete in terms of emotion components. This latter version allowed a larger range of emotion terms to fit the narrative.

We also kept the complexity of the narratives equivalent across their different versions. Table 2 shows an example of a narrative in each context.

Questionnaire about the emotional narratives. Three booklets containing eight narratives in the *optimal* version, eight narratives in the *suitable* version, and eight narratives in the *moderate* version were constructed. In each booklet, a narrative appeared in only one version and the order of presentation of the narratives was random. For each narrative, three emotion labels (from the set of emotions investigated in the GRID study) were proposed. The first emotion label corresponded to the emotion intended by the authors and to the combination of features present in the story. The second emotion label corresponded to a synonymous emotion term when possible or to an emotion term matching the described situation (e.g., *pleasure* in the *happiness* narrative, or *hate* in the *anger* narrative). The third emotion term corresponded to an emotion of the same valence as the intended emotion that also matched the situation but was not synonymous (e.g., *interest* in the *happiness* narrative or *anxiety* in the *anger* narrative). The emotion labels were presented in a semi-random order.

Procedure.

Each participant received one of the three booklets. The participants were asked to read each narrative of the booklet carefully and to order the three emotion labels from the most relevant to the narrative to the least relevant.

Results and discussion

In this pilot study, we wanted to ensure that our narratives would lead to a high agreement among participants about which emotion is ranked first, especially for the *optimal* versions. Still, as these narratives were elaborated on the emotion features identified by the GRID instrument and contained at least three typical features of the emotion (i.e., in the *moderate* condition), we expected the participants to generally rank the intended emotions as first and those of the same valence as last.

In Table 3, we present the percentage of choices of each emotion type across the different versions. The choice of the intended emotion label as the best label for the story was constant among the different versions of the narratives, $F(2,46) = 1.00$, $MSE = 1.68$, and was clearly above chance (33%), $t(23) = 7.68$, $p < .001$.

As expected, the narratives constructed based on typical features of emotion components identified by the GRID instrument elicited a high choice rate (65%) of the intended emotions compared to synonymous emotions (27%) or emotions of the same valence (8%), and this was the case in all three versions. Although no definitive conclusion regarding the emotion labels that readers would spontaneously generate can be made from these results, they confirm that all versions of the narratives are congruent with the intended emotions (i.e., which become the target emotions in Experiments 1, 2, and 3), even more so than those used by Gygax et al. (2004), who found an agreement of 49% on the intended emotion when presenting participants with Gernsbacher et al.'s (1992) original narratives. These results also confirm that even though synonymous emotions might share similar features for some or all of their components, our narratives allowed our participants to differentiate between these emotions, at least off-line. Finally, this study suggests that the GRID instrument provided us with the appropriate materials on which to base our materials.

Note that, as this Pilot study was off-line by nature, these results could be taken as support for the idea that, if readers are provided with the appropriate information, they may build specific emotion representations, at least off-line. However, nothing can yet be said about the on-line status of these inferences, which is central to Experiment 1.

Experiment 1

The Pilot study mainly showed that the GRID instrument provided us with the appropriate materials on which to base our experimental narratives. In the present experiment, we went a step further and investigated the on-line construction of the protagonist's emotional state using narratives based on the GRID. The aim of this experiment was to test the influence of contextual support, in terms of emotion components, on the mental representations of emotions. Embodied views of cognition suggest that previous experiences of emotion may be central to the understanding of any emotional situation, hinting that this may also be the case when understanding emotion from text (Barsalou, 1999; Havas, Glenberg, & Rinck, 2007; Niedenthal, Winkielman, Mondillon, & Vermeulen, 2009). Consequently, readers may construct their mental representations of a protagonist's emotional state on the basis of different stereotypical emotional features. Moreover, as presented before, research on predictive inferences suggests that increasing the contextual support in terms of emotion components would activate more specific emotion representations. We therefore hypothesized that readers are more likely to infer an intended emotion when presented with all the emotion features that are highly consistent with this emotion (i.e., in the *optimal* condition). A decrease in contextual support (i.e., in the *suitable* or *moderate* conditions) may result in a less specific representation. If reading times of target sentences mirror how similar the information in these sentences is to readers' mental representations, as argued in previous studies based on the *match vs. mismatch* paradigm, we should expect slower reading times of

the target emotion sentence in the *moderate* than in the *suitable* condition, which should, in turn, be slower than in the *optimal* condition.

Method

Participants.

Sixty-four participants (50 women) of an introductory psychology course from the University of Fribourg (Switzerland) took part in this experiment. All participants spoke French as their first language. The participants were aged from 18 to 44 (M = 22.87, SD = 4.59).

Material.

Emotional narratives. The same emotional narratives as in the Pilot study were used in this experiment. We added a target sentence containing the intended emotion (i.e., the one from the GRID instrument) at the end of each story.

Each participant saw eight narratives in the *optimal* version, eight narratives in the *suitable* version, and eight narratives in the *moderate* version. In each version set, half of the narratives were presented with the appraisal and expression components appearing at the beginning of the narrative, and the other half of the narratives with the action tendency and psychophysiology components appearing first. To ensure that all narratives would be seen in all versions across the experiment and that participants would be included in all experimental condition versions, we constructed six lists.

Filler narratives. Twenty-four filler narratives were added to the experimental narratives. These narratives were written in the same style as the experimental narratives but were constructed so as not to transmit any emotional information. They were mainly aimed at ensuring that the participants did not uncover the aim of the experiment.

The narratives were randomly presented using PsyScope Software (Cohen, MacWhinney, Flatt, & Provost, 1993). Reading times of each sentence were collected using a response button box attached to the computer, which permits millisecond accuracy.

Additional post-experimental questionnaire. To investigate individual differences, at the end of the experiment, we repeated the same procedure as in the Pilot study in order to ensure that each participant agreed with the emotion labels we included in the narratives. Each participant saw the narratives in the same version as in the experiment.

Procedure.

Participants were asked to read the narratives at their normal pace, as if they were at home reading a magazine. At the beginning of each narrative, the message "Are you ready?" appeared on the screen. The participants pressed the "yes" button in order to make the first sentence appear. Each narrative was presented one sentence at a time. After having read each sentence, the participants pressed the "yes" button to make the following sentence appear. The time to read each sentence (i.e., from its appearance to the button press) was recorded. Some narratives (n = 14) were followed by a question related to the text that required a "yes" or "no" answer in order to ensure that all participants paid adequate attention to the narratives. Before the beginning of the experiment participants were presented with three practice narratives.

After the completion of the self-paced reading task, participants filled in the questionnaire about the emotional narratives.

Results

Data transformation.

Reading times were transformed in order to take into account the characteristics of the sentences (i.e., length and position in the experiment) and those of the participants (i.e., individual natural reading speed), as advocated by Trueswell, Tanenhaus, and Garnsey

(1994). This method of transformation is particularly adequate, as it not only accounts for sentence length, but also the fact that reading pace naturally increases as the experiment unfolds. Following the method introduced by Ferreira and Clifton (1986), further discussed in Trueswell et al. (1994) and used in Gygax et al. (2007), we calculated, for each participant, and separately for each sentence, a regression equation of time (i.e., reading time) against length (i.e., number of syllables in the sentence), introduced as first predictor, and position of the sentence in the experiment (i.e., trial number), introduced as second predictor. We subtracted the actual reading time from the time predicted by the regression to obtain residual reading times. A positive residual reading time therefore means that the time to process the sentence was longer than expected. Residual reading times that fell more than 2.5 SD above or under each participant's mean of each sentence were replaced by their cutoff value (2.4% of the data). The analyses were done on the residual reading times. All analyses were conducted both by-participants (F1) and by-items (F2) (Clark, 1973).

Reading times of the target sentences.

We hypothesized that when more contextual support for the emotion information was included in the narrative, the emotion inference would be more specific. As the moderate version of each narrative contained the least contextual support for a specific emotion, we expected that readers in this condition should be less likely to infer the intended specific emotion than in the two other conditions. This should be reflected in slower reading times of the target sentences in the moderate than in the suitable condition, which should, in turn, be slower than in the optimal condition.

Unexpectedly, our results (see Figure 1) showed the opposite pattern: there was a significant linear trend indicating that residual reading times were higher with increased contextual constraint; readers were 45 ms slower to read the target sentences in the *optimal* version than in the *moderate* version, $F_1(1, 63) = 5.33$, $MSE = 12092.87$, $p = .02$, $F_2(1, 23) =$

4.71, $MSE = 6252.78$, $p = .04$, whereas no differences were found between the *suitable* and the other two versions of the narratives.

In order to be certain that this result could not be attributed to a mismatch effect associated with the fact that some participants may have considered the emotion terms in the final sentences as not appropriate (despite the results in the Pilot study), we eliminated, for each reader, the narratives for which they did not choose the intended emotional label in the additional post-experimental questionnaire about the emotional narratives they had just seen in the experimental task. The analyses still showed the exact same pattern, with the linear trend still being present in the same direction both by-participants $F_1(1, 63) = 6.49$, $MSE = 19163.30$, $p = .013$, and by-items $F_2(1, 21) = 5.06$, $MSE = 7955.41$ $p = .035$.

There was also no difference related to the order of presentation of the components in the narratives.

Discussion

Our results seem to challenge our initial idea that enhancing the emotion context in terms of emotion components in narratives contributes to more specific representations of the main protagonist's emotional state. Readers indeed seemed slower to map the intended emotions onto their ongoing mental representations in the optimal, highly congruent version than in the moderate, less congruent version. Note that the reading time difference was extremely fine-grained, unlike the one related to mismatch sentences generally found in the habitual *match vs. mismatch* paradigm. Still, this result is quite different from what could be expected from previous findings. Different explanations can be advanced.

One possible explanation is that the slowdown in the reading time of the target sentence associated with the increase in contextual support, may mirror a demanding *integration* process (as opposed to "only" a mapping process), through which readers build a deep and specific representation of the protagonist's emotion. In fact, it is well accepted that

discourse comprehension, through inference generation, can be considered a two-stage process, whereby information is first *activated*, and then *integrated* into mental representations (e.g., Gernsbacher, 1997; Gerrig & O'Brien, 2005, Kintsch, 1988, Sanford & Garrod, 2005). For example, according to Gernsbacher's structure building framework (Gernsbacher, 1997), readers habitually build mental representations (or structures) by (1) laying a foundation for the mental representation activated by the text, and (2) mapping subsequent information onto this foundation. When subsequent information is not congruent with the foundation, readers shift to different mental representations and elaborate new foundations for them. Very importantly, building a foundation takes time, whereas simply mapping new information does not, given that the new information is coherent with the foundation (Gernsbacher, 1997). We therefore suggest that when reading a congruent, yet less constraining, emotional context, readers keep an open representation of emotion, composed on several components and on which different emotions can easily be mapped onto (as suggested by Gygax et al., 2003, 2004). Consequently, when encountering the target emotion in the *moderate* condition, this emotion is very likely to be easily mapped onto the existing mental representation. When encountering the target emotion in the *optimal* condition, however, as the text itself provides sufficient information to justify a restrictive choice, readers may not only map the target emotion onto their current foundation, but also integrate this emotion into their mental representation of the text and *update* their foundation based on it. This integration and updating process takes more time to finalize than a more simple mapping process.

Still, alternative explanations can be advanced. First, it is possible that the slowed reading time is related to the amount of emotion information provided in the narratives. In the optimal condition, readers may take more time to map the emotion target sentences because

they may have to map target sentences onto more information than in the moderate condition, hence taking more time to finalize the mapping process.

Relatedly, if one were to follow past interpretations of slowed reading times by the book, we would have to assume that they actually reflect mismatch effects. To follow this idea, one could argue that, as more contextual emotional support was provided to readers in the optimal version of the narratives, the amount of relevant emotional information activated may be relatively small compared to that activated in the moderate version of the narrative. In other words, and similarly to what has been found in research on predictive inferences (e.g., Lassonde & O'Brien, 2009), a highly constraining context may simply diminish the amount of available lexical candidates. When encountering the emotion term in the *optimal* version, the pre-activated relevant emotion terms (i.e., candidates) may be different from the emotion term contained in the sentence, leading to a somewhat mismatch effect reflected in slower reading times. In the *moderate* version of the narratives, such a mismatch effect is unlikely given that more emotion candidates are activated.

However, since the narratives were constructed so as to establish a context allowing for the elaboration of specific inferences, and since the pattern of reading times was the same when considering only the narratives for which the participants chose the intended emotion in the post-experiment questionnaire, it seems unlikely that readers struggled to map the target optimal sentences onto their current mental representations of the character's emotion. To clarify this issue, we decided to use a different task that directly and explicitly taps into mapping processes.

Experiment 2

Experiment 2 was designed to investigate simple mapping processes related to the emotion target sentences presented in Experiment 1. As previously discussed, the narratives were constructed so as to convey a highly constraining emotion context in the optimal

version, which we hypothesized should lead to more specific emotion representations. These specific representations were expected to be mirrored in facilitated mapping of the target sentence containing the protagonist's emotion in the optimal compared to the moderate condition. We actually believe the results of Experiment 1 to signal not only mapping processes but also integration ones involved in text comprehension. In Experiment 2, we tried to directly assess the difficulty to map target sentences onto the preceding context (i.e., onto the readers' mental representations), to rule out a *mismatch* interpretation of the results in Experiment 1.

In order to do so, we used a "makes sense" judgment task (Tanenhaus & Carlson, 1990), requiring explicit judgments of congruency between target sentences and their preceding contexts. More specifically, we explicitly asked participants, for each narrative, to decide, as fast as possible, whether the target sentence was a *sensible continuation* of the preceding narrative. This task has been used in a number of experiments interested in mapping processes of particular information to its antecedent context (e.g., Tanenhaus & Carlson, 1990, on anaphoric resolution; Garnham, Oakhill, & Reynolds, 2012, and Sato, Gygax, & Gabriel, 2013, on gender inferences). In this task, response latencies are particularly important and informative, as they precisely signal (i.e., more precisely than reading times according to Tanenhaus & Carlson, 1990) the ease in which certain textual elements can be mapped onto readers' mental representation of the text.

In this experiment, as in Experiment 1, we investigated the same matching target sentences in different contexts of congruency. As we believe the "makes sense" judgment task only tackles mapping processes, the following hypotheses were tested: (1) if readers experience a possible mismatch effect when encountering the tested emotion in the target sentences in the optimal version, we would expect judgment times to be slower in the optimal than in the moderate condition (in a similar pattern as the one found in Experiment 1); (2) if

readers do not experience a mismatch when reading the target emotion (and a different process was involved in Experiment 1), we would expect readers to make positive judgments slower in the moderate than in the optimal condition.

Method

Participants.

Thirty-six students (29 women) of an introductory psychology course from the University of Fribourg (Switzerland) took part in this experiment. All participants spoke French as their first language. The participants were aged from 18 to 24 (M = 21.4, SD = 2.39). One participant was removed from the analyses, as they did not understand the instructions.

Material and Design.

Emotional and filler narratives. Considering the linear trend across the three conditions in Experiment 1, we decided to only use the *optimal* and *moderate* narratives in Experiment 2. By doing so, we also increased power, as each list comprised more narratives per condition. Since the order of presentation of the component sentences in Experiment 1 did not influence the results, we constructed two lists, containing 12 optimal emotional narratives, 12 moderate emotional narratives, and 24 filler narratives. Out of the 24 filler narratives, the last sentence of 12 was modified in order to elicit a clear "no" response in the judgment task, whereas all emotional narratives were expected to elicit a "yes" response. The narratives were randomly presented using PsyScope Software (Cohen et al., 1993).

Procedure.

As in Experiment 1, participants were presented with the narratives and asked to read them at their normal pace. The narratives were presented one sentence at a time and the participants were asked to press the “yes” button at the end of each sentence in order to see the following sentence. The final sentence of each narrative always appeared in green, which

prompted participants to judge, as fast as possible, whether the final sentence was a sensible continuation of the preceding narrative ("yes") or not ("no").

Results

The same data transformation, to account for sentence length as well as trial position, as in Experiment 1 was applied. All analyses were performed on the residual response times. 4.7 % of the data were replaced by their 2.5 SD cutoff values.

Proportions of positive responses.

In this experiment, we assessed the difficulty of mapping the target emotion sentences onto readers' mental representations. The proportions of matching target sentences evaluated as sensible continuations of the preceding context were very high (93.4% in the moderate condition and 96.3% in the optimal condition), which strongly supports the idea that none of the target sentences actually mismatched readers' mental representations elaborated during reading.

Positive judgment response times.

If the results of Experiment 1 were due to mismatching effects as a consequence of our experimental narratives, mapping processes should be disrupted in the optimal narratives, which would be reflected in slower positive judgment times in the optimal condition compared to the moderate condition. However, if, as we hypothesized, the slowed reading times observed in Experiment 1 mirrored more subtle processes than only mapping ones, then judgment times should be slower in the moderate than in the optimal condition.

Supporting this second hypothesis, participants were 77 milliseconds slower to say that the target sentences were sensible continuations of the preceding context in the moderate than in the optimal condition, $F_1(1, 35) = 2.63$, $MSE = 43017.98$, $p = .057$ (one-tailed), $F_2(1, 23) = 3.52$, $MSE = 20218.33$ $p = .037$ (one-tailed). Although the analysis was stronger when

considering items as a random factor, we do believe this result to be quite impressive, especially as we were only dealing with congruent sentences.

Discussion

In Experiment 2, we directly tested the difficulty of mapping congruent emotion sentences onto their representation of the preceding narrative as a function of the emotional contextual support provided in the narrative. We found that in both congruent (i.e., moderate) and constraining (i.e., optimal) versions of the narratives, readers almost always judged the target sentence as consistent with the preceding context. Yet, as expected, they were slower to judge the target sentence as a sensible continuation of the preceding narrative in the moderate condition than in the optimal condition.

The results of this experiment challenge the idea that the slowed reading times observed in Experiment 1 were attributable to possible mismatch effects or to a difficulty in mapping the target sentences onto the emotional context of the narratives. On the contrary, they support our hypothesis that enhancing the emotional contextual support in narratives helps readers to infer specific emotions. Still, the results of this experiment do not directly support our hypothesis that the slowed reading times found in Experiment 1 mirror integration processes, which we aimed to examine more thoroughly in Experiment 3.

Experiment 3

Experiment 3 was designed to investigate whether the slowed reading times found in Experiment 1 were related to integration and updating processes. Previous research (e.g., Seifert, Robertson, & Black, 1985) has shown that when readers infer new information, they store this new information as a part of the memory of the narrative. According to the integration hypothesis presented in Experiment 1, when an emotion is presented after a constraining contextual support, readers not only map but also integrate the emotion into their mental representations of the text and consequently update these representations. According

to this idea, an emotion following the highly constraining context of the *optimal* version should show a stronger memory trace than the same emotion following the *moderate* version. In order to put this hypothesis to test, we used a recognition memory test straight after the same task as in Experiment 1. In this test, which was only introduced and explained to our participants when they had completed the self-paced reading task (i.e., to avoid strategic reading processes in the reading experiment), we asked participants to decide as fast and as accurately as possible whether a list of emotion terms (presented one after the other) had been presented during the self-paced reading task. For each participant, we were particularly interested in response differences between those emotions that had been presented in the optimal version and those in the moderate version of the narratives. More specifically, according to our integration hypothesis, we expected participants to recognize emotions more appropriately when the emotions were included in the optimal compared to the moderate version.

Method

Participants.

Eighty-seven students (74 women) of an introductory psychology course from the University of Fribourg (Switzerland) took part in this experiment. All participants spoke French as their first language. The participants were aged from 18 to 43 (M = 21.9, SD = 4.04). Two participants were excluded from the recognition test because they clearly did not understand the instructions or their data were not recorded.

Materials and Design.

Emotional and filler narratives. The same experimental narratives as in Experiment 2 (i.e., only the *optimal* and *moderate* versions of the narratives) and the same filler narratives as in Experiment 1 were used. As in Experiment 2, we constructed two lists, containing 12

optimal emotional narratives, 12 moderate emotional narratives, and 24 filler narratives. The narratives were randomly presented using PsyScope Software (Cohen et al., 1993).

Emotion words used in the memory recognition test. To the 24 emotion words actually presented in the reading task, we added 24 synonymous emotion words (e.g. *satisfaction* [satisfaction] for *être content* [contentment], *inquiétude* [worry] for *anxiété* [anxiety], or *étonnement* [astonishment] for *surprise* [surprise]). We decided to use synonymous emotion words in order to avoid ceiling effects in the participants' recognition rates for the target emotions and to ensure that they would intensively concentrate. The synonymous emotions were identified through the lexical portal hosted on the website of the French National Center of Textual and Lexical Resources (http://www.cnrtl.fr/portail). For each emotion word presented in the narratives, we chose the closest synonym in the database, provided that this synonym had not already been used in one of the narratives.

Procedure.

As in Experiment 1, the participants were first presented with the narratives and asked to read them at their normal pace, one sentence at a time. After the reading part of the experiment, the participants completed the memory recognition task. They had to decide as quickly and as accurately as possible whether each of the 48 emotion words had previously been presented in the reading task. Each word was preceded by fixation crosses for 1000 ms, and appeared on the screen until the participants gave their response by pressing on the "yes" or "no" button. Following each decision, participants also indicated the extent to which they were confident in their response on a scale from *1 = not certain at all* to *7 = totally certain*. The order of presentation of the emotion words was randomized.

Results

Reading times of the target sentences.

The same data transformation to account for sentence length as well as trial position as in Experiments 1 and 2 was applied on the reading times. 5.1 % of the reading times were replaced by their 2.5 SD cutoff values.

As expected, in this experiment, we found the same results as in Experiment 1, namely that participants were 50 ms slower to read the target emotion sentence in the *optimal* compared to the *moderate* version of the narratives, $F_1(1, 86) = 10.74$, $MSE = 11658.34$, $p = .002$, $F_2(1, 23) = 5.26$, $MSE = 6502.92$, $p = .031$.

Memory recognition task.

In the memory recognition task, 81.1 % ($SD = 9.7$) of the emotion words were correctly recognized, whereas 34.6 % ($SD = 18.8$) of the synonymous emotion words were falsely recognized. Participants were also more confident in their responses concerning target emotions than synonymous emotions, $F(1, 77) = 174.15$, $MSE = .47$, $p < .001$. These initial results demonstrate that our participants were generally very good at recognizing emotions that had truly been presented in the reading time task.

Most importantly, according to our integration hypothesis, when looking at target emotions, the number of correct responses was larger in the *optimal* ($M = 9.34$) than in the *moderate* condition ($M = 8.96$), $t(84) = -1.67$, $p < .05$ (one-tailed). Although participants were 60 ms slower to recognize emotions that had been presented in the *moderate* version ($M = 1670$, $SD = 76$) compared to emotions that had been presented in the *optimal* version ($M = 1610$, $SD = 62$), this difference did not reach statistical significance, $t = 1$. There was no other significant statistical effect.

Discussion

In Experiment 3, we replicated the results found in Experiment 1: slower reading times for target emotion sentences following constraining (i.e., optimal) narratives than for the same target emotion sentences following congruent (i.e., moderate) narratives. We also tested the

hypothesis that slower reading times in the optimal condition mirror an integration process whereby readers not only map but also integrate the protagonist's emotion into their representations of the text, consequently updating the foundation of their mental representations.

Our memory recognition task first showed that readers were, in general, good at differentiating target emotions from synonymous emotions. This suggests that although different lexical items can be activated during inference processes, encountering a specific emotion in the target sentence enhances the activation of this emotion in readers' mental representations. Second, our participants were better at recognizing emotions that had previously been presented in the *optimal* version than those that had been presented in the *moderate* version. This result supports our claim that enhancing the emotional contextual support in narratives leads to better emotion representations, which are more strongly encoded in readers' memory.

Finally, as there was no effect of judgment confidence between the optimal and the congruent versions, our results suggest that the memory traces we accessed were rather passive.

General discussion

In the experiments presented in this paper, we assessed the influence of contextual support on emotional inferences. Previous research has shown that readers include some characteristics pertaining to the protagonist in their mental representations of the text, such as emotions (e.g., de Vega, Leon, & Diaz, 1996; Gernsbacher et al., 1992, 1998, Gygax et al., 2003, 2004, 2007) or traits (e.g., Rapp et al., 2001). In past studies, researchers have often constructed narratives describing behaviors or situations that would elicit inferences related to these characteristics. By varying the focus of the narratives as well as the narrative outcomes, previous research showed that reading target sentences that evoke the *specific* characters'

traits or emotions described in the narratives was easier compared to reading target sentences that evoke more *general* traits or emotions. In the present study, we investigated the specificity of emotion inferences as a function of the contextual support (in terms of emotion components), by using a *congruency levels* paradigm. We think that this paradigm, contrary to the usual *match vs. mismatch* paradigm, allowed us to investigate fine-grained processes involved when different contexts constrain readers' mental representations.

We constructed narratives describing emotional states on the basis of emotional features described in emotion research (Fontaine et al., 2013). We manipulated the amount of emotion components included in the narratives, as well as the congruency of their associated features. A pilot study showed that all versions of our narratives (i.e., optimal, suitable, and moderate) elicited a high choice rate of the intended emotions when participants were asked to choose the most relevant emotions between the intended one and two others (i.e., a synonymous and a same valence emotion). As the pilot study was off-line, it could not truly document the processes occurring while reading, yet it confirmed that all versions of the narratives were congruent with the intended emotions.

In Experiment 1 (moving to on-line process examination), we compared matching emotion sentences following the different contextual supports and showed that, most importantly, target sentences containing the intended emotions were read slower after the *optimal* version of the narratives (i.e., most constraining context) than after the *moderate* version (i.e., least constraining context). Although at first this effect was somehow surprising, in Experiments 2 and 3, we essentially showed that the slowed reading time associated with the *optimal* contextual support (1) was unlikely attributable to mismatch or attention effects (Experiment 2), and (2) was associated with better memory recognition of the related emotions (Experiment 3).

The rather small yet highly informative reading time differences found in our experiments suggest that deeper processes than the ones investigated so far with the *match vs. mismatch* paradigm are in play when elaborating mental representations of the main protagonist's emotional state. In fact, the experiments presented in this paper suggest two different processes: A mapping process (most apparent in Experiment 2) and an integration and updating one (most apparent in Experiments 1 and 3), with the latter being resource demanding, hence the longer reading times of target sentences in the *optimal* condition.

We suggest that generally, when reading narratives about emotions, readers elaborate mental representations of the protagonist's emotional state based on the available features of the components of this emotion. These representations may remain quite open (i.e., any congruent emotion can be mapped onto them) as long as the narratives do not constrain them by conveying necessary components and their associated typical and salient emotion features. When these are conveyed, readers may gradually build a strong and specific foundation based on the relevant emotion.

Previous evidence suggests that readers *can* construct specific representations, most likely by diminishing the amount of lexical candidates for a given inference, as demonstrated in the domain of predictive inferences (e.g., Lassonde & O'Brien, 2009; Rapp et al., 2001). In terms of emotion inferences, the experiments presented here, although documenting the possibility of specific representations, do not allow us to draw definite conclusions regarding the amount of potential candidates activated while reading our narratives. In a similar way, the paradigm used in this paper does not allow us to determine whether precise emotional inferences were constructed on-line or if they were driven by the target sentences containing specific emotion terms. Still, we consider our results, especially those from Experiment 2, to suggest that readers do construct more elaborate representations of emotions while reading,

which is mirrored by congruent sentences in highly constraining contexts being more easily responded to compared to congruent sentences in less congruent contexts.

Furthermore, we suggest that an appropriate emotional context may drive readers to *integrate* the main protagonist's emotional state into their mental representations in a specific way, at least when encountering the target emotion. This integration process, whereby readers update the foundation of their mental representations, is mirrored by the longer reading times (Experiments 1 and 3) when processing target sentences following highly constraining contexts, and is supported by better memory recognition for the emotions within these target sentences.

However, although we did show that the emotion construct provided by the narratives is important before readers reach the target sentences, the *exact* information included by readers in their mental representations *before* reaching the target sentences remains to be identified (i.e., the forward inference processes). Future studies using paradigms that allow such identification, as well as the systematic investigation of specific lexical candidates (e.g., lexical decision or naming tasks) would be required to confirm our hypothesis.

Future studies could also confirm the importance of emotion construct (as hinted by our experiments), by systematically manipulating the presence or absence of all defining components. Even though the component process model (Scherer, 1984, 2009) postulates that all components are required for an emotional experience, it is still possible that some components might be more important in the comprehension of some emotions, and less important for others.

Note that one could also explain our results, especially the unexpected ones, in other ways. For example, we interpreted longer reading times as reflecting integration processes, but actually, it might be argued that we looked at attention processes. As the narratives were highly relevant in the *optimal* condition in terms of the protagonist's emotional state,

participants may have allocated more attention to the target sentences, without really having to integrate the information included in them into their mental representations. However, in Experiment 3, the memory results do suggest some integration processes, inasmuch as participants were better at recognizing emotions that had been presented in *optimal* narratives.

In terms of past research on the specificity of emotion inferences, Gernsbacher and colleagues were right to assume that precise representations of emotions were possible, yet the necessary conditions for them to happen were not clear. Gygax and colleagues were right to assume that under normal conditions, readers build rather broad representations of emotion, onto which a large number of emotions can be mapped, yet they failed to acknowledge the possibility of specific emotion representations. In all, we consider our data to constitute an initial step towards bringing together psycholinguistic research on emotion inferences and emotion construct research. They also suggest that, given the appropriate emotion context, readers can reach specific representations of the protagonist's emotion.

References

Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral & Brain Sciences*, *22*, 577–660. http://doi.org/10.1017/S0140525X99002149

Casteel, M. A. (2007). Contextual support and predictive inference: What do readers generate and keep available for use. *Discourse Processes*, *44*, 51–72. http://doi.org/10.1080/01638530701285572

Clark, H. H. (1973). The language-as-fixed-effect fallacy: A critique of language in psychological research. *Journal of Verbal Learning and Verbal Behavior*, *12*, 335–359. http://doi.org/10.1016/S0022-5371(73)80014-3

Cohen, J., MacWhinney, B., Flatt, M., & Provost, J. (1993). PsyScope: An interactive graphical system for designing and controlling experiments in the psychology laboratory using Macintosh computers. *Behavior Research Methods, Instruments and Computers*, *25*, 257–271. http://doi.org/10.3758/BF03204507

Cook, A. E., Limber, J. E., & O'Brien, E. J. (2001). Situation-based context and the availability of predictive inferences. *Journal of Memory and Language*, *44*, 220–234.

De Vega, M., Leon, I., & Diaz, J. M. (1996). The representation of changing emotions in reading comprehension. *Cognition and Emotion*, *10*, 303–322. http://dx.doi.org/10.1080/026999396380268

Ellsworth, P. C., & Scherer, K. R. (2003). Appraisal processes in emotion. In R. J. Davidson, K. R. Scherer, & H. H. Goldsmith (Eds.), *Handbook of affective sciences* (pp. 572–595). New York: Oxford University Press.

Fontaine, J. R. J., Scherer, K. R., Roesch, E. B., & Ellsworth, P. (2007). The world of emotion is not two-dimensional. *Psychological Science*, *18*, 1050–1057. http://doi.org/10.1111/j.1467-9280.2007.02024.x

Fontaine, J. R. J., Scherer, K. R., & Soriano, C. (Eds.). (2013). *Components of emotional*

meaning: A sourcebook. Oxford: Oxford University Press.

Garnham, A., Oakhill, J., & Reynolds, D. (2002). Are inferences from stereotyped role names to characters' gender made elaboratively? *Memory & Cognition*, *30*, 439–446. http://doi.org/10.3758/BF03194944

Gernsbacher, M. A. (1997). Two decades of structure building. *Discourse Processes*, *23*, 265–304. http://doi.org/10.1080/01638539709544994

Gernsbacher, M. A., Goldsmith, H. H., & Robertson, R. R. W. (1992). Do readers mentally represent characters' emotional states? *Cognition and Emotion*, *6*, 89–111. http://doi.org/10.1080/02699939208411061

Gernsbacher, M. A., Hallada, B. M., & Robertson, R. R. W. (1998). How automatically do readers infer fictional characters' emotional states? *Scientific Studies of Reading*, *2*, 271–300. http://doi.org/10.1207/s1532799xssr0203_5

Gerrig, R. J., & O'Brien, E. J. (2005). The scope of memory-based processing. *Discourse Processes*, *39*, 225–242. http://doi.org/10.1080/0163853X.2005.9651681

Graesser, A. C., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. *Psychological Review*, *101*, 371–371. http://doi.org/10.1037//0033-295X.101.3.371

Gygax, P. M., Garnham, A., & Oakhill, J. (2004). Inferring characters' emotional states: Can readers infer specific emotions? *Language and Cognitive Processes*, *19*, 613–638. http://doi.org/10.1080/01690960444000016

Gygax, P. M., Oakhill, J., & Garnham, A. (2003). The representation of characters' emotional responses: Do readers infer specific emotions? *Cognition and Emotion*, *17*, 413–428. http://doi.org/10.1080/02699930244000048

Gygax, P., Tapiero, I., & Carruzzo, E. (2007). Emotion inferences during reading comprehension : What evidence can the self-pace reading paradigm provide?

Discourse Processes, *44*, 33–50. http://doi.org/10.1080/01638530701285564

Havas, D. A., Glenberg, A. M., & Rinck, M. (2007). Emotion simulation during language comprehension. *Psychonomic Bulletin and Review*, *14*, 436–441. http://doi.org/10.3758/BF03194085

Johnson-Laird, P. N. (1983). *Mental models*. Cambridge, MA: Harvard University Press.

Kintsch, W. (1988). The role of knowledge in discourse comprehension: A construction-integration model. *Psychological Review*, *95*(2), 163–182. http://doi.org/10.1037/0033-295X.95.2.163

Lassonde, K. A., & O'Brien, E. J. (2009). Contextual specificity in the activation of predictive inferences. *Discourse Processes*, *46*(5), 426–438. http://doi.org/10.1080/01638530902959620

McKoon, G., & Ratcliff, R. (1986). Inferences about predictable events. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *12*, 82–91. http://doi.org/10.1037//0278-7393.12.1.82

Niedenthal, P. M., Winkielman, P., Mondillon, L., & Vermeulen, N. (2009). Embodiment of emotion concepts. *Journal of Personality and Social Psychology*, *96*, 1120–1136. http://doi.org/10.1037/a0015574

Rapp, D. N., Gerrig, R. J., & Prentice, D. A. (2001). Readers'trait-based models of characters in narrative comprehension. *Journal of Memory and Language*, *45*, 737–750. http://doi.org/10.1006/jmla.2000.2789

Sanford, A. J., & Garrod, S. (2005). Memory-based approaches and beyond. *Discourse Processes*, *39*, 205–224. http://doi.org/10.1080/0163853X.2005.9651680

Sato, S., Gygax, P. M., & Gabriel, U. (n.d.). Gender inferences: Grammatical features and their impact on the representation of gender in bilinguals. *Bilingualism: Language and Cognition*, *16*, 792–807. http://doi.org/10.1017/S1366728912000739

Scherer, K. R. (1984). On the nature and function of emotion: A component process approach. In K. R. Scherer & P. Ekman (Eds.), *Approaches to Emotion* (pp. 293–317). Hillsdale, NJ: Erlbaum.

Scherer, K. R. (2000). Psychological models of emotion. In J. Borod (Ed.), *The neuropsychology of emotion* (pp. 137–162). Oxford: Oxford University Press.

Scherer, K. R. (2005). What are emotions? And how can they be measured? *Social Science Information*, *44*, 695–729. http://doi.org/10.1177/0539018405058216

Scherer, K. R. (2009). Emotions are emergent processes: they require a dynamic computational architecture. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*, 3459–3474. http://doi.org/10.1098/rstb.2009.0141

Seifert, C. M., Robertson, S. P., & Black, J. B. (1985). Types of inferences generated during reading. *Journal of Memory and Language*, *24*, 405–422. http://doi.org/10.1016/0749-596X(85)90037-3

Tanenhaus, M. K., & Carlson, G. N. (1990). Comprehension of deep and surface verb phrase anaphors. *Language and Cognitive Processes*, *5*, 257–280. http://doi.org/10.1080/01690969008407064

Trueswell, J. C., Tanenhaus, M. K., & Garnsey, S. M. (1994). Semantic influence on syntactic processing: Use of thematic information in syntactic disambiguation. *Journal of Memory and Language*, *33*, 265–312. http://doi.org/10.1006/jmla.1994.1014

Footnote

[1]In essence, our manipulation constitutes a *within-narrative* design (i.e., the same narrative compared in all conditions), which is important inasmuch as some emotions may be composed of components of different weight than other emotions.

Table1

French Emotions Terms (and Their Translation into English) Investigated in Fontaine et al. (2007) and Used in The Experiments of This Paper

Bonheur (Happiness), Joie (Joy), Etre content (Contentment), Plaisir (Pleasure), Fierté (Pride), Colère (Anger), Amour (Love), Peur (Fear), Tristesse (Sadness), Désespoir (Despair), Honte (Shame), Intérêt (Interest), Irritation (Irritation), Jalousie (Jealousy), Culpabilité (Guilt), Anxiété (Anxiety), Surprise (Surprise), Haine (Hate), Déception (Disappointment), Etre blessé (Being hurt), Dégoût (Disgust), Mépris (Contempt), Stress (Stress), Compassion (Compassion).

Table 2

Example of an Emotional Narrative (and Its Translation into English) Used in The Pilot Study and Experiments 1, 2, and 3 in The Three Context Versions. In The Pilot Study, The Final Target Sentence Was Not Presented. Instead, Participants Had to Rank Three Possible Emotions in Terms of Salience to The Narrative.

Optimal version
Context sentence: *Lors d'une discussion animée, Emilie insulta sa meilleure amie qui n'était pas d'accord avec elle. (During a lively discussion, Emily insulted her best friend who did not agree with her.)*
Expression component: *Aussitôt les mots sortis de sa bouche, Emilie se tut. (As soon as she uttered the words, Emily fell silent).*
Psychophysiology component: *En même temps, elle eut une boule à l'estomac. (At the same time, she felt a knot in her stomach).*
Appraisal component: *Alors qu'elle aurait pu se retenir, Emilie avait cédé à une impulsion. (Although she could have resisted, Emily had yielded to an impulse.)*
Action Tendency component: *En se remémorant ce qu'elle venait de dire, Emilie eut envie de disparaitre dans un trou de souris. (Remembering what she had just said, Emily wanted to disappear into a mouse hole).*
Subjective Feeling component: *A ce moment, Emilie se sentait mal. (At that moment, Emily felt bad).*
Target sentence: *Emilie ressentait de la culpabilité.* (*Emily felt guilty).*
Suitable version
Context sentence: *Lors d'une discussion animée, Emilie insulta sa meilleure amie qui n'était*

pas d'accord avec elle. (During a lively discussion, Emily insulted her best friend who did not agree with her.)

Expression component: *Aussitôt les mots sortis de sa bouche, Emilie changea la mélodie de sa voix. (As soon as she uttered the words, Emily changed the melody of her voice).*

Psychophysiology component: *En même temps, tous les muscles de son corps se tendirent.* (*At the same time, all the muscles in her body tensed).*

Appraisal component: *Alors qu'elle aurait pu se retenir, Emilie avait cédé à une impulsion. (Although she could have resisted, Emily had yielded to an impulse.)*

Action Tendency component: *En se remémorant ce qu'elle venait de dire, Emilie eut envie de disparaitre dans un trou de souris. (Remembering what she had just said, Emily wanted to disappear into a mouse hole).*

Subjective Feeling component: *A ce moment, Emilie se sentait mal. (At that moment, Emily felt bad).*

Target sentence: *Emilie ressentait de la culpabilité.* (*Emily felt guilty).*

Moderate version

Context sentence: *Lors d'une discussion animée, Emilie insulta sa meilleure amie qui n'était pas d'accord avec elle. (During a lively discussion, Emily insulted her best friend who did not agree with her.)*

Filler neutral sentence: *Les deux amies se trouvaient alors chez Emilie.* (*The two friends were then at Emily's place.)*

Filler neutral sentence: *Toutes deux parlaient de leur journée.* (*They were talking about their day.)*

Appraisal component: *Alors qu'elle aurait pu se retenir, Emilie avait cédé à une impulsion. (Although she could have resisted, Emily had yielded to an impulse.)*

Action Tendency component: *En se remémorant ce qu'elle venait de dire, Emilie eut envie de disparaitre dans un trou de souris. (Remembering what she had just said, Emily wanted to disappear into a mouse hole).*

Subjective Feeling component: *A ce moment, Emilie se sentait mal. (At that moment, Emily felt bad).*

Target sentence: *Emilie ressentait de la culpabilité.* (*Emily felt guilty).*

Table 3

Percentages of Choice of The Different Emotions in The Three Versions of The Emotional Narratives in The Pilot Study

Versions	Intended label	Similar label	Same valence label
Optimal	64.39	28.54	7.07
Suitable	64.05	27.34	8.61
Moderate	66.96	25.99	7.07

Figure captions

Figure 1. Mean differences in residual reading times of the emotional target sentence across the three versions of the narratives in Experiment 1. The same target sentences follow different emotional contextual supports.

Figure 2. Mean differences in residual decision times in Experiment 2. The same target sentences follow different emotional contextual supports.

Figure 3. Mean differences in residual reading times of the emotional target sentence across the two versions of the narratives in Experiment 3. The same target sentences follow different emotional contextual supports.